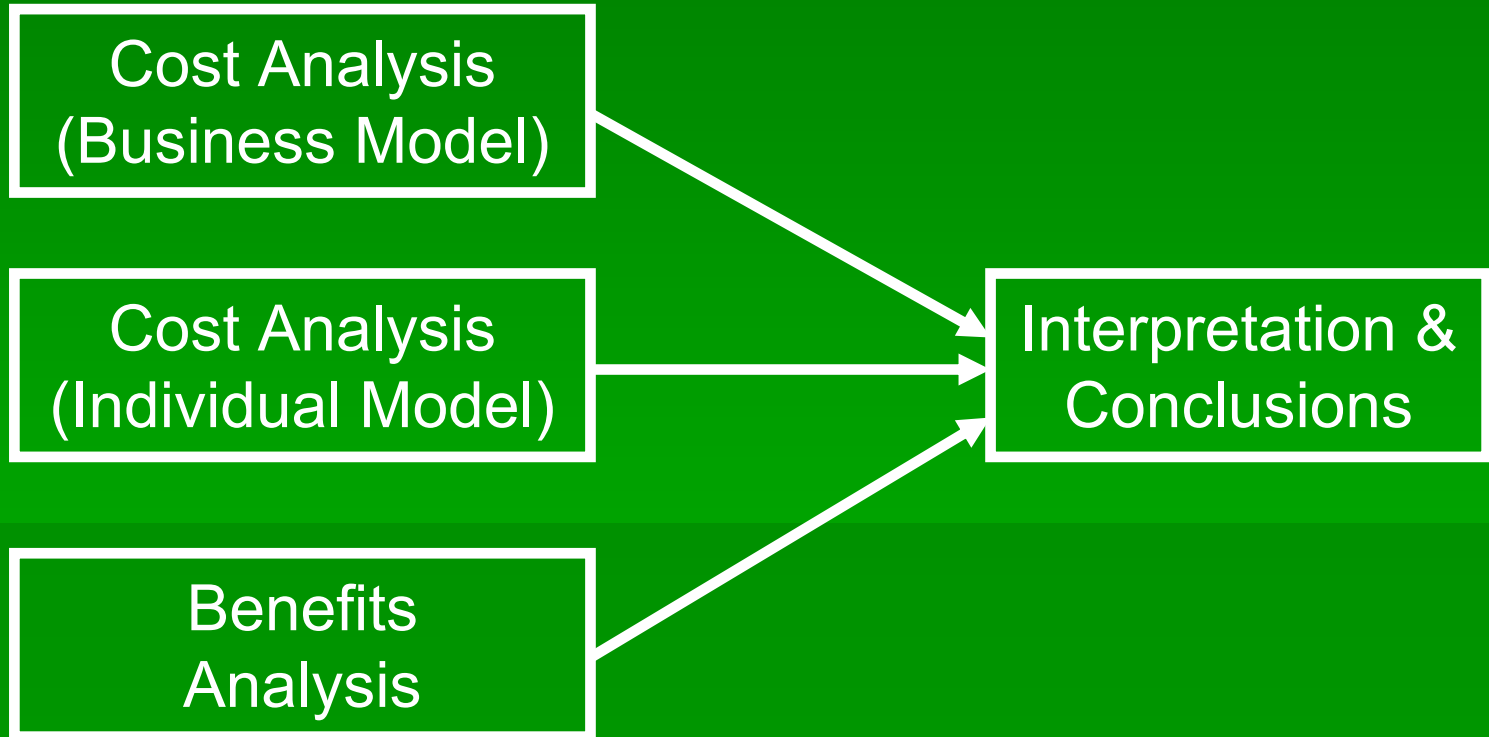


Cost Benefit Analysis

Overview



Business model:

total costs to business v. overall societal benefits

Formula for determining total costs:

- $$\text{Total Cost} = \text{Total affected sales} \times \text{\% Price increase}$$

Where:

- Total affected sales = the share of sales that would have to be replaced by deca-free product.
- % Price increase = the expected percentage price increase

Cost Endpoints

- Quantified
 - Computers
 - TVs
- Non Quantified
 - Other consumer electronics (clocks, cameras, DVD players, etc.

Business model: assumptions

- Affected sectors: wholesalers and retailers
- Some companies that have already removed Deca-BDE will continue deca-free
- Some companies will postpone or reverse the transition to deca-free because of EU exemption
- Estimates of final price increases range from 2-15%

Business model: results

- Survey of WA wholesalers and retailers to estimate % of sales of PBDE-containing products that would be affected by a ban
 - Poor response rate
 - Small numbers problem/selection bias
- Uncertainties too great to draw conclusions

Individual model:

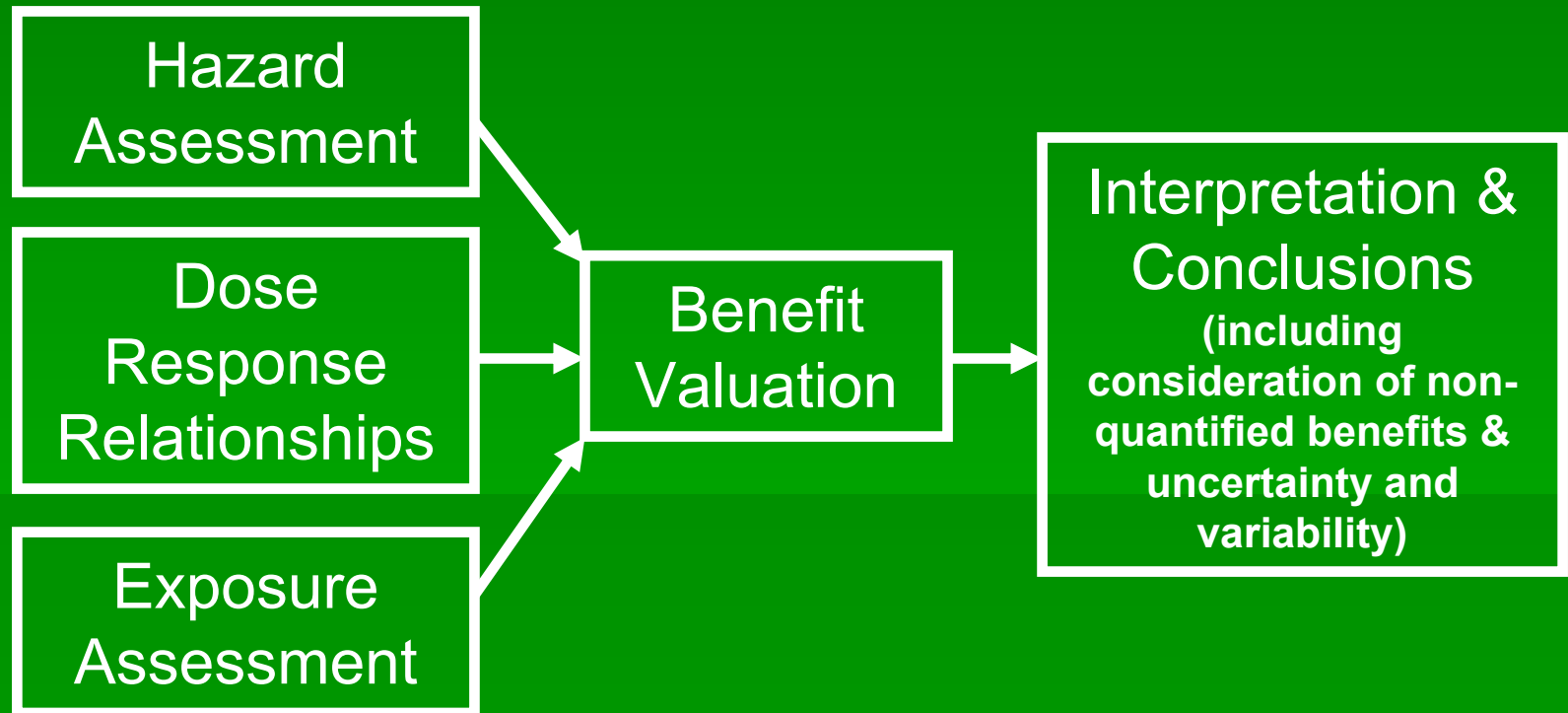
Answers the question:

“What price increase created by a ban would be required to offset the health gains created by a WA ban on Deca-BDE?”

Types of Benefits

- Human Health Benefits
- Amenity Benefits
- Ecological Benefits
- Remediation Benefits

Approach for Benefits Analysis



Health Benefits Model

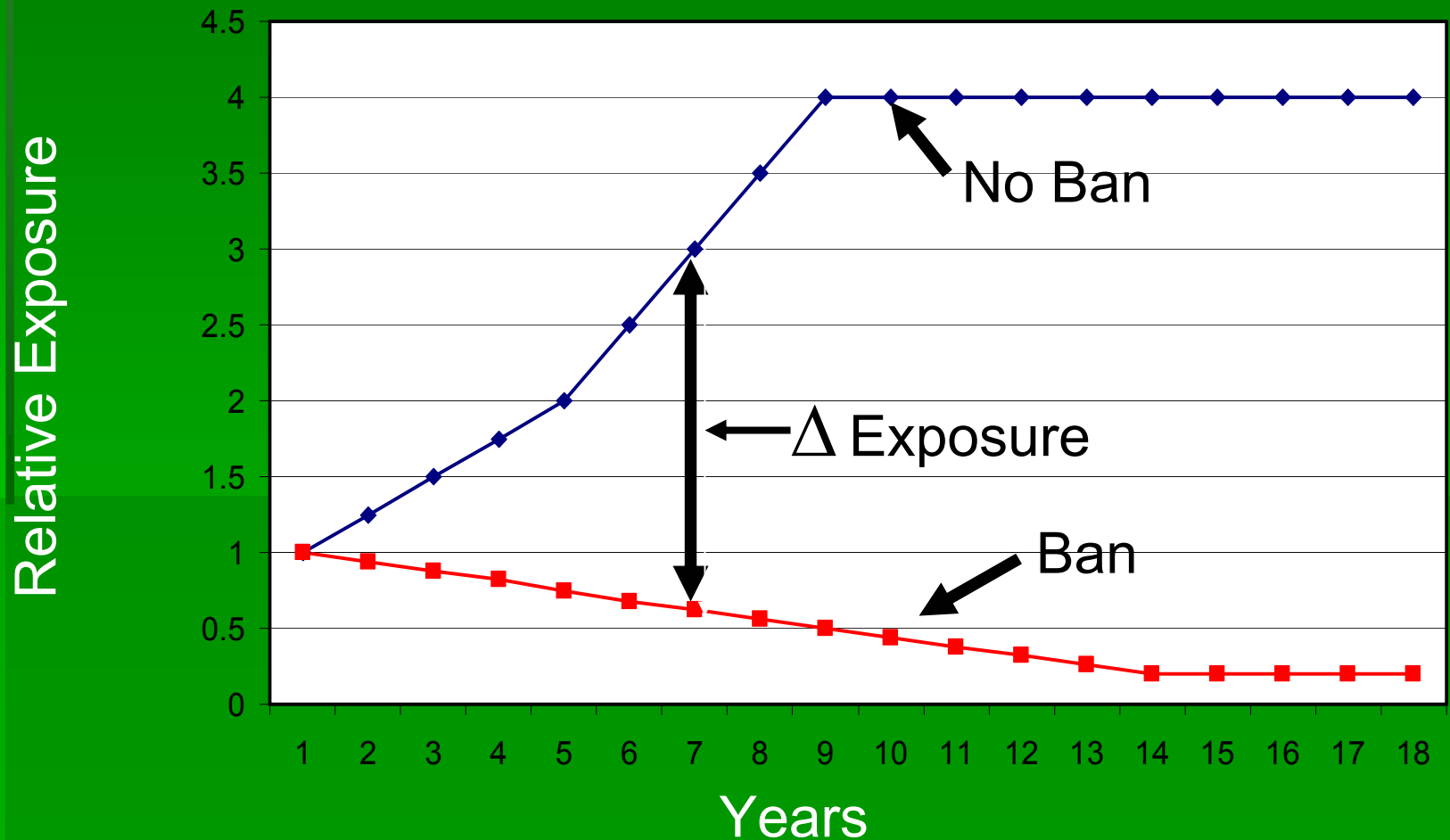
$$\text{Estimated health benefits/year} = \Delta E * (\beta * CF) * N * V$$

- **ΔE = Estimated exposure to Deca-BDE for various population groups (current and projected) (mg/kg/day);**
- **β = Health risk factor relating changes in exposure to changes in health endpoint of concern (mg/kg/day)⁻¹;**
- **CF = Conversion Factor to account for differences in absorption between Deca-BDE & surrogate chemicals (if any);**
- **N = Population at risk (i.e. estimated number of people exposed to Deca-BDE (current and projected);**
- **V = Estimated dollar benefit associated with health impact (\$/health impact).**

Key Assumptions

- Results from animal bioassays can be used to predict human health risks
- Toxicity/dose response information from structurally similar chemicals can be used to predict human health risks
- Results from high exposure studies can be extrapolated to lower exposure levels
- Exposure data from other parts of the US can be used to predict exposure for WA residents

Incremental Exposure



Benefit Endpoints

Quantified

- Human Health Benefits
 - Thyroid-related effects on development
 - Thyroid-related systemic effects
 - Effects on neurological development
 - Cancer

Non-Quantified

- Human Health Benefits
 - Immune system
 - Liver damage
 - Hearing impairment
 - Cardiovascular
- Amenity Benefits
- Ecological Benefits
- Remediation Benefits

Preliminary Results – Thyroid Example

Increased # of Children Born to Women Who Are Hypothyroid					
		Hazard (1 Significant Figure)			
		None	Low	Mid-Range	High
Exposure	Low	0	10	20	30
	Mid-Range	0	20	30	60
	High	0	80	200	300

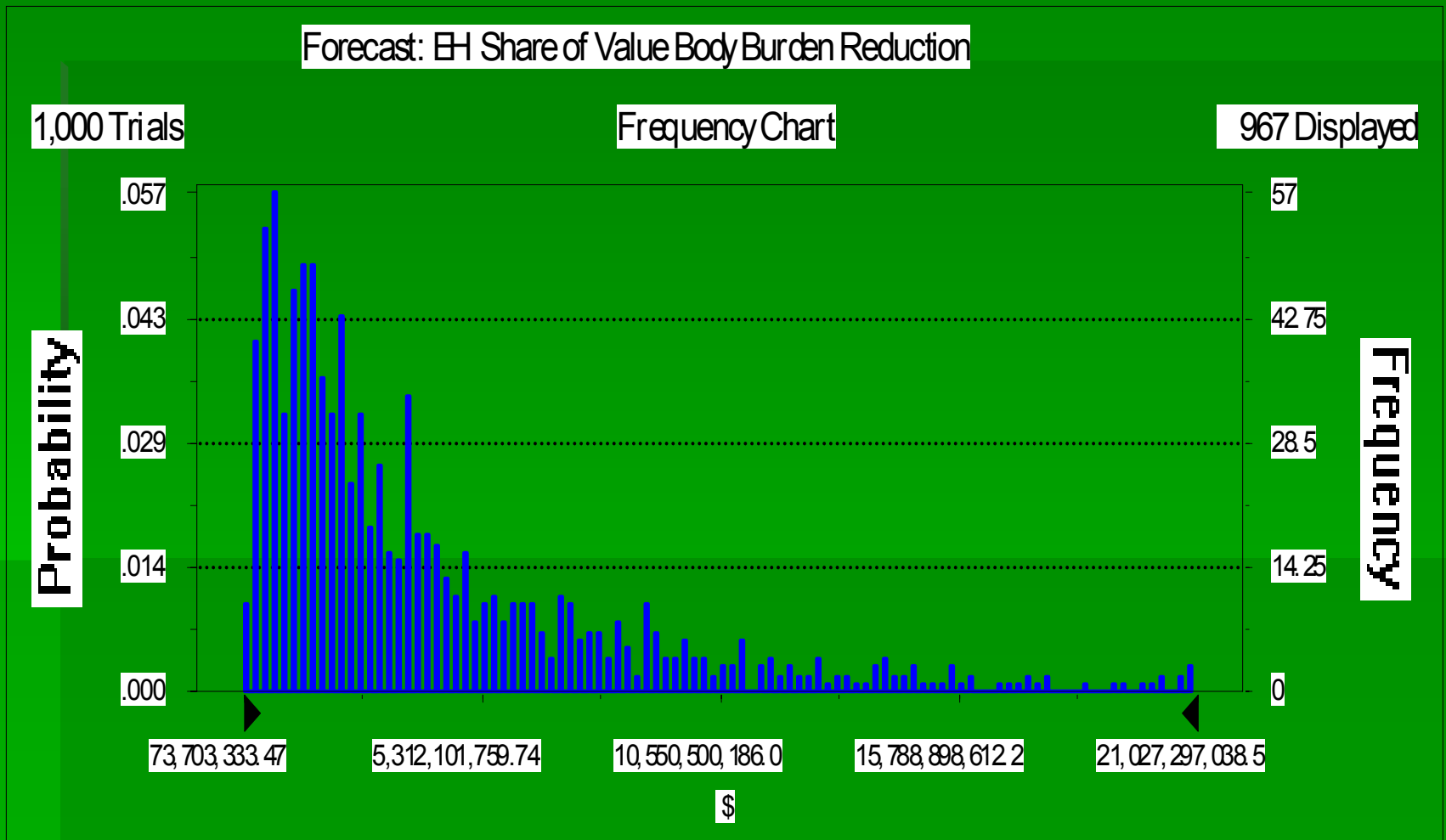
Preliminary Results – Benefits (Health Outcomes)

Health Outcomes Prevented	Estimates (1 significant figure)			
	None	Low	Mid	High
Incremental Change in # of Children Born to Women that are Hypothyroid	0	8	30	300
Incremental Change in # of People Who are Hypothyroid	0	600	2,000	10,000
Incremental Change in Population IQ	0	100	500	3,000
Incremental Change in Cancer Deaths/Year	0	< 1	4	400
Incremental Change in Cancer (Non-Fatal)/Year	0	< 1	1	100

Valuation of Benefits

- Cost of Illness
 - \$14,500 in lost earnings/IQ point
 - \$4 million/loss of statistical life
 - \$27,000 for cancer treatment (per year)
 - \$8,000 for thyroid treatment (per year)
- Assumptions on Timing
 - Future use of Deca-BDE (baseline)
 - Rate of decline in exposure following ban, etc)
- Discount Rate = 2.29%/year

Large Range of Benefits



Price Shift Break Even

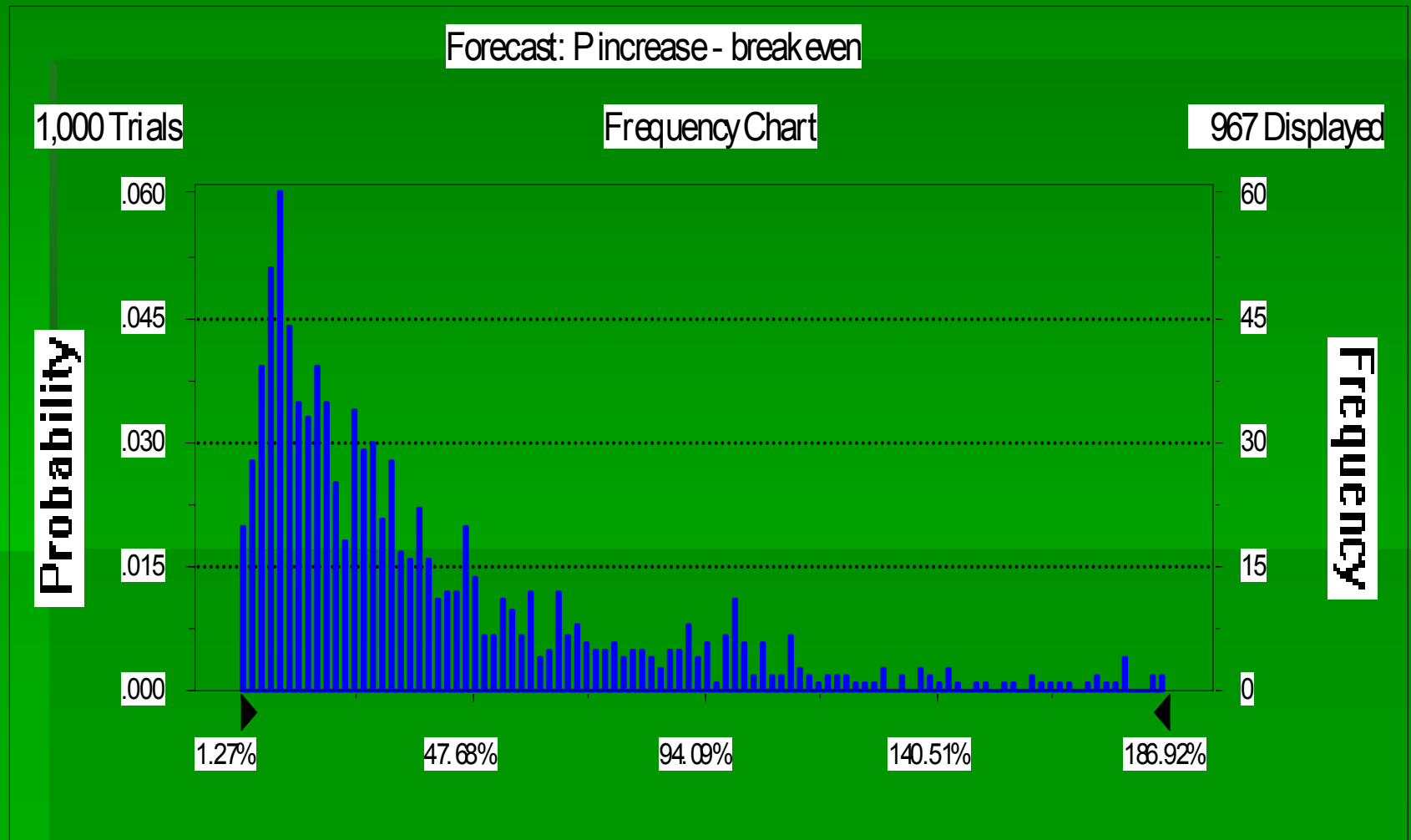
= B/E

- Prices
 - TV = \$465
 - Computer = \$1,600
- Rough Rotation
 - TV = 17.5 years
 - Computer = 6.2 years
- New data coming

Green Companies ~ 54%

- Dell
- Hitachi
- HP
- Motorola
- Panasonic
- Samsung
- Sony
- Apple
- Brothers
- Canon
- Daikin
- Toshiba
- Royal Philips Electronics

Price Break Even Range



Conclusions

- Business model:
Potentially high costs/high benefits
- Individual model:
Potentially high costs/high benefits